Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE PERMIAN, TRIASSIC, AND JURASSIC FORMATIONS IN THE EAST-INDIAN ARCHIPELAGO (TIMOR AND ROTTI).[1]

BY AUGUST ROTHPLETZ.

TWO years ago my friend Wichmann, professor in the University of Utrecht, in Holland, sent me a rich collection of Mesozoic and Paleozoic fossils, which he had made during his geological exploration of the Dutch colonies in India, in 1888-'89. All these fossils came from the west side of the island of Timor and the little neighbor island of Rotti.

Timor is a locality well known for Carboniferous fossils, which were described in 1865 by Professor Beyrich, in Berlin. He knew then eighty species from a little river near Kupang, and from another place one Ammonite, which he considered as a representative of the Mesozoic fauna. But Professor Wichmann found nearly the same Ammonites in the Paleozoic strata of that little river near Kupang. Therefore we must regard all these Ammonites as of Paleozoic age.

Though Triassic strata are not yet known at Timor, they have been found on Rotti by Wichmann, with the shells of European species of Monotis and Halobia; and in the mud of a volcano have been included, together with some Paleozoic fossils, like those of Timor, a few truly Jurassic remains,—also in part of European character. From the Paleozoic strata I know at present forty-three species, of which twenty-five are not yet known from any other country. The other eighteen only give us the opportunity to make out the exact age of these deposits. I shall mention them especially:

Six species are spread out over many parts of the earth and during many epochs of the Carboniferous and Permian periods: *Spirigera royssi*, *Spirifer lineatus*, *Spiriferina cristata*, *Productus semireticulatus*, *Fenestella virgosa*, and perhaps *Amplexus coralloides*. Three species are found in the Upper Carboniferous and Permian strata of India; and in part of Russia: *Terebratula himalayensis*, *Retzia grandicosta*, and *Spirifer musateheylensis*. Nine species at least belong only to the Permian period, and seven of them have been found in the Salt range of India, three in Armenia, and one in Russia.

---

[1] Read before the American Geological Society, August 24th, 1891.

So we have in Timor no species which could be considered as of exclusively Carboniferous age (except perhaps *Amplexus coralloides*), but nine species of exclusively Permian age; and therefore we cannot doubt that the fossiliferous Paleozoic strata of Timor belong really to the Permain period.

In favor of this opinion may also be mentioned the presence of Ammonites, which are not yet known as having existed in the Carboniferous period. The *Ammonites megaphyllus*, which was described by Beyrich, and placed, together with the Triassic *Ammonites farbas*, in a particular group, has since played a remarkable part in the story of systematic arrangement.

First it was raised by Mojsisovics to the rank of a head of the genus Megaphyllites, in 1878. But after a few years the head got disgusted with his family, and fell in love with a young American lady, called by Hyatt *Propanoceras* (1886), in whose bonds he remained but a very short time, for he had become a very fickle fellow, and was running after some other Russian and Italian ladies, as Waagenia, Waagenina, and Stacheoceras. But these seem to have been only transitory passions, and, becoming older and calmer, he found at last the harbor of the genus Arcestes, where I hope he will pass his days peacefully, together with his new compatriot, the *Arcestes tridens*.

Now we have to consider another very interesting fact: that none of the exclusively Permian species of Timor occur in Australia or America. This seems to prove that Timor was a part of that Permian sea that covered the northern part of East India, Armenia, and Russia, and which was limited at the south, and perhaps at the east too, by that old Australian-Indian and African continent on which, in the same time, the wonderful Glossopteris flora was growing.

So also no near relations exist with the middle and northern parts of Europe. The European flora and marine fauna of the

Permian period is more distinguished from the Carboniferous flora and fauna by the dying out of older species and genera than by the growing up of new types. It looks as if Europe, with her shallow seas and her isolated and often inundated land masses, had been at that time the refuge for the Carboniferous world, which was retiring from the battle with younger and stronger people that came in from the east and south.

Therefore, if we would become acquainted with the true Permian flora and fauna, we must not address ourselves to Europe, but to the eastern and southern continents. There we find the marine fauna in a free and rich developement like that which we are accustomed to see in the Lower Carboniferous period in Europe; and this gives to the eastern Permian fauna an appearance by which it looks more related to the older Carboniferous than to the contemporaneous Permian fauna of Europe. Some geologists have been really disappointed by that appearance, and take the true Permian fauna as the development of a separate period that existed between the Carboniferous and the Permian periods, and which they have called the Permo-Carboniferous period.

But in this they are quite wrong. The aggregation of Carboniferous and Permian species in the fauna at the beginning of the Permian period is nothing extraordinary or nothing that should not be expected. We know the same as existing on the boundaries of the Triassic and Liassic, of the Jurassic and Cretaceous, of the Cretaceous and Tertiary periods. The fact is sufficiently marked by the names of Rhætic and Infraliassic, of Tithonic and Berrias, and of Laramie.

The Triassic formation is represented on the island of Rotti by white, gray, and red limestone plates, sometimes full of bivalves, Except one new species, *Halobia wichmannii*, I could state the presence of six European species: *Monotis salinaria*, *Halobia lommeli*, *lineata*, *charlyana* (syn. of *mediterranea* Gemallaro), *norica* and *Daonella cassiana*. All are representatives of the upper Alpine Trias, three have also been found in Sicily and two in the Himalaya. Therefore we must suppose that, as in the Permian period, so also in the Triassic time, a large sea-basin existed that covered and united Europe and East India.

But as the Permian fauna did not show a close relation to the eastern fauna, so also there are no relations between the East Indian Triassic fauna and that of New Caledonia, New Zealand, and Japan, where the Monotis seems to be represented by the genus Pseudomonotis.

That this remarkable connection of the East-Indian archipelago with Europe by the intervention of the Himalaya still continued during the Jurassic period is proved by the discovery of Liassic and Oölitic fossils on the island of Rotti,—as, for example, *Arietites geometricus*, *Harpoceras* cf. *Eserii*, and *Belemnites gerardii*.

It is probable that only after the Jurassic period the East-Indian archipelago came out of direct connection with the European sea, and remained so until now.